**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
OSB1999-0112

September 15, 1999

Mr. Howard Jones
U.S. Army Corps of Engineers, Portland District
ATTN: Mr. Bob Willis
P.O. Box 2946
Portland, Oregon 97232

Re: Biological Opinion on Corps of Engineers' Columbia River Channel Operation and Maintenance Program

Dear Mr. Jones:

Enclosed is the National Marine Fisheries Service's (NMFS) biological opinion on the Columbia River Channel Operation and Maintenance Program as described in the U.S. Army Corps of Engineer's Biological Assessments (BAs) dated February 9, 1999 and July 21, 1999. This opinion addresses Snake River sockeye salmon (*Oncorhynchus nerka*), Snake River spring/summer chinook salmon (*O. tshawytscha*), Snake River fall chinook salmon (*O. tshawytscha*), Lower Columbia River steelhead (*O. mykiss*), Upper Columbia River steelhead (*O. mykiss*), Snake River steelhead (*O. mykiss*), Upper Willamette River steelhead (*O. mykiss*), Middle Columbia River steelhead (*O. mykiss*), Columbia River chum salmon (*O. keta*), Lower Columbia River chinook salmon (*O. tshawytscha*), Upper Willamette River chinook salmon (*O. tshawytscha*), Upper Columbia River spring run chinook salmon (*O. tshawytscha*), and Southwestern WA/Columbia River coastal cutthroat trout (*O. clarki clarki*). This opinion constitutes formal consultation for those listed species. The NMFS has determined that the subject action, as proposed, is not likely to jeopardize the continued existence of those listed species.

Sincerely,

William Stelle, Jr.
Regional Administrator

Enclosure

Endangered Species Act - Section 7
Consultation

# BIOLOGICAL OPINION

Columbia River Navigation Channel
Operation and Maintenance Program

Agency: U.S. Army Corps of Engineers - Portland District

Consultation Conducted By: National Marine Fisheries Service,
Northwest Region

Date Issued: September 15, 1999

Refer to: OSB1999-0112

TABLE OF CONTENTS

## I. BACKGROUND

The U.S. Army Corps of Engineers (COE) maintains the Federal Navigation Channel in the Columbia River through operation and maintenance dredging. The previous formal consultation (December 22, 1993) for operation and maintenance dredging expired on December, 1998. In a February 9, 1999, supplemental Biological Assessment (BA) for the Columbia River Channel Navigation Operation and Maintenance Program, the COE determined that the program may affect listed species and requested reinitiation of formal consultation. In addition, the COE submitted an amendment to the proposed action on July 21, 1999.

Consequently, the objective of this Biological Opinion is to determine whether operation and maintenance dredging of the Columbia River Navigation Channel below McNary Dam is likely to jeopardize the continued existence of salmonid species listed under the Endangered Species Act (Table 1), or result in the destruction or adverse modification of their designated or proposed critical habitat.

There have been several previous consultations conducted on the COE's Operation and Maintenance Dredging activities: an August 1, 1991, informal consultation for use of Interim Area D Estuarine Disposal Site in Clatsop County, Oregon; a February 25, 1992, informal consultation for construction of the Wahkiakum Ferry Channel at Puget Island, Washington; a March 5, 1992, informal consultation for emergency dredging sites in the Columbia River; a December 11, 1992, informal consultation for expansion of Columbia River dredged material disposal sites; a November 5, 1993, informal consultation for conducting Dungeness crab entrainment studies in Baker Bay, Washington; a December 22, 1993, formal consultation on Columbia River operation and maintenance dredging; a September 14, 1994, reinitiation of the December 22 formal consultation to address designated critical habitat; an April 6, 1996, informal consultation on hopper and pipeline dredging in the Columbia River; a September 22, 1995 formal consultation on repair of pile dikes in the Lower Columbia River; a July 25, 1996 reinitiation of the September 22 formal consultation to address additional pile dikes; an August 2, 1996 informal consultation on replacement of a navigational aid in the Lower Columbia River; a May 28, 1998, informal consultation for the maintenance dredging program to address listing of Snake River and Upper Columbia River steelhead and a May 27,1999, informal consultation to begin dredging operations at the mouth of the Columbia River. In addition, NMFS provided comments March 24, 1997, on the Dredged Material Management Plan and the proposed Channel Deepening Project (March 24, 1997 and February 2, 1999).

## II. PROPOSED ACTION

The proposed action is the continued operation and maintenance of the authorized Federal Navigation Channel from the mouth of the Columbia River (river mile -3) upriver to McNary Dam (River mile 292) through a combination of dredging (hopper, pipeline, agitation and clamshell dredges), hydraulic control works (pile dikes) and navigational range markers. The Operation and Maintenance Program is divided into projects for four areas of the river: Mouth of the Columbia River (MCR) Project from river mile -3 to 3; the Columbia and Lower Willamette River (C&LW) Project from river mile 3 to 106.5 in

the Columbia River and 0 to 11 in the Willamette River; the Vancouver to the Dalles Project from river mile 106.5 to 192; and the Dalles Dam to McNary Dam Project from river mile 192 to 292.

Table 1: Species considered in this Biological Opinion

| **Common Name** | **Scientific Name** | **Listing Status** |
|---|---|---|
| Snake River sockeye salmon | *Oncorhynchus nerka* | Listed (Endangered) |
| Snake River spring/summer chinook salmon | *O. tshawytscha* | Listed (Threatened) |
| Snake River fall chinook salmon | *O. tshawytscha* | Listed (Threatened) |
| Lower Columbia River steelhead | *O. mykiss* | Listed (Threatened) |
| Upper Columbia River steelhead | *O. mykiss* | Listed (Endangered) |
| Snake River steelhead | *O. mykiss* | Listed (Threatened) |
| Upper Willamette River steelhead | *O. mykiss* | Listed (Threatened) |
| Middle Columbia River steelhead | *O. mykiss* | Listed (Threatened) |
| Columbia River chum salmon | *O. keta* | Listed (Threatened) |
| Lower Columbia River chinook salmon | *O. tshawytscha* | Listed (Threatened) |
| Upper Willamette River chinook salmon | *O. tshawytscha* | Listed (Threatened) |
| Upper Columbia River spring run chinook salmon | *O. tshawytscha* | Listed (Endangered) |
| Southwestern WA/Columbia River coastal cutthroat trout | *O. clarki clarki* | Proposed (Threatened) |

Dredging will occur yearly for those areas below Bonneville Dam and on an as needed basis above Bonneville Dam. Estimated dredging volumes for the MCR project are 4-5 million cubic yards (mcy) annually, 4-6.5 mcy for the C&LW project and .08 -.226 mcy for the Vancouver to Bonneville Dam area. Areas above Bonneville Dam have been seldom dredged in the past and only in response to shoaling.

There are 12 side channels below Bonneville Dam that are also maintained (at varying frequencies) by the COE: Baker Bay West Channel (40-50,000 cubic yards every 3-4 years) at river mile 2.5; Chinook Channel (150-200,000 cubic yards every 1-2 years) at river mile 5; Hammond Boat Basin (infrequently) at river mile 7; Skipanon Channel (20-50,000 cubic yards every 1-3 years) at river mile 10; Tongue Point (not maintained) at river mile 17; Skamokawa (infrequently) at river mile 33.6; Elochoman (infrequently) at river mile 37; Westport Slough (infrequently) at river mile 43; Cowlitz River Old Mouth (10-20,000 cubic yards anually) at river mile 67; St. Helens Cross Channel (infrequently) at river mouth 87; Oregon Slough (50,000 cubic yards every 3-5 years) at river mile 102; and Government Island (infrequently) at river mile 116.

Disposal of the dredged material would occur at ocean disposal sites, flow lane sites (throughout the channel in waters between 45 to 65 feet deep and along the North Jetty), numerous upland sites, and one beach nourishment site at Miller Sands. Ocean disposal sites are currently being developed in

coordination with NMFS, the Environmental Protection Agency, U.S. Fish and Wildlife Service and state agencies from Oregon and Washington. Disposal in flow lane sites will generally occur in waters 45 to 65 feet in depth. However, between river miles 64 and 68 and river miles 90 and 101 disposal will occur in depths between 35 and 65 feet. Disposal will occur in waters deeper than 65 feet on the Oregon side of the channel between river miles 30 and 33 and 54 and 56, between river miles 72.2 and 73.2 on the Washington side of the channel and at river mile 3 at the end of the Jetty A site. Material from Baker Bay will also be placed in the Jetty A site. These deep sites are non-erosive and will eventually be filled. Depth after 20 years of deposition will still be greater than 65 feet. Upland sites are proposed for various areas all along the channel. Six adjacent beach nourishment sites will be utilized until the upland sites can be acquired, located at O-86.2, O-46.8, W-46.0, W-46.3, O-38.3 and O-27.2. These six sites have been evaluated for benthic productivity, approved by NMFS and utilized for disposal in the past.

The COE also maintains the navigation channel through hydraulic control structures, the most common being a series of pile dikes. The pile dikes control channel alignment, provide bank protection, reduce erosion and provide for dredge material disposal areas. The COE currently utilizes and maintains 236 pile dikes along the navigation channel. The Corps proposes to add an additional pile dike field at Jones Beach (River Mile 47).

In addition, the COE maintains approximately 40 navigational range markers that are utilized by vessels transiting the navigation channel. The range markers are used primarily to serve as location aids for dredge operators. The COE plans to remove these structures beginning in April of 2000, with completion of the removal scheduled for September 2000 (J. Gornick, COE , personnel communication March 2, 1999).

Timing for conducting maintenance dredging is scheduled for March to October in the mainstem portion of the C&LW project (usually commencing in June) and the MCR project. The upriver areas and side channels are proposed to be dredged during the in-water work period of November 1 to February 28 up to Bonneville Dam and from November 15 to March 15 from Bonneville Dam to John Day Dam. Clamshell dredging of the side channel areas is proposed to be done year round as necessary. The Cowlitz River Old Mouth Project is proposed to be dredged during July 15 to August 15 by agitation dredge, as well as during the approved work window of November 1 to February 28. The Government Island Channel is also proposed to be pipeline dredged from July 15 through February 28.

To reduce impacts resulting from avian predator usage of COE facilities, the COE proposes to prevent nesting of avian predators on Rice Island, a dredge disposal site, beginning in the year 2000. The COE also proposes to develop, implement and monitor techniques to prevent avian predator usage of pile dikes beginning in 2000.
This is the COE's proposed plan for operation and maintenance of the navigation channel for the next 20 years. However, the COE is only asking for the consultation to be valid for a five year period from the date of issuance, upon which time reinitiation will be required.

## III. BIOLOGICAL INFORMATION AND CRITICAL HABITAT

Based on migratory timing, it is likely that adult and juvenile salmon or steelhead from listed or proposed species would be present in the action area during the proposed dredging operations. The proposed action would occur within designated critical habitat for some of the listed salmon species.

An action area is defined by NMFS regulations (50 CFR Part 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The area within designated critical habitat affected by the proposed action is the mouth of the Columbia River upstream to McNary Dam at river mile 292. This area serves as a migratory corridor for both adult and juvenile life stages of all listed and proposed species under consideration in this BO. In addition, chum salmon are known to spawn around the islands immediately below Bonneville Dam.

Essential features of the adult and juvenile migratory corridor for the species are: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (primarily juvenile), (8) riparian vegetation, (9) space, and (10) safe passage conditions. The essential features this proposed project may affect are substrate, water quality, food, riparian vegetation and safe passage conditions resulting from dredging and dredge disposal activities.

This action area is within critical habitat for designated species as indicated by references cited in Table 2. References for further background on listing status and biological information can also be found in Table 2.

## IV. EVALUATING PROPOSED ACTIONS

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consultation regulations). NMFS must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of (1) defining the biological requirements and current status of the listed species, and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NMFS evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NMFS must consider the estimated level of mortality attributable to: (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmon's life stages that occur beyond the action area. If NMFS finds that the action is likely to jeopardize, NMFS must identify reasonable and prudent alternatives for the action.

Table 2. References for additional background on listing status, biological information, and critical habitat elements for the Listed and Proposed Species addressed in this biological and conference opinion.

| Species | Listing Status Final Rule | Critical Habitat | Biological Information, Historical Population Trends |
|---|---|---|---|
| Snake River Sockeye Salmon | November 20, 1991; 56 FR 58619 | December 28, 1993; 58 FR 68543 (FINAL RULE) | Waples *et al*. 1991a; Burgner 1991 |
| Snake River Fall Chinook Salmon | April 22, 1992; 57 FR 34653 | December 28, 1993; 58 FR 68543 (FINAL RULE) | Waples *et al*. 1991b; Healey 1991 |
| Snake River Spring/Summer Chinook Salmon | April 22, 1992; 57 FR 34653 | December 28, 1993; 58 FR 68543 (FINAL RULE) | Matthews and Waples 1991; Healey 1991 |
| Upper Willamette River Chinook Salmon | March 24, 1999; 64 FR 14308 | March 9, 1998; 63 FR 11482 (PROPOSED RULE) | Myers *et al*.1998; Healey 1991 |
| Upper Columbia River Spring Chinook Salmon | March 24, 1999; 64 FR 14308 | March 9, 1998; 63 FR 11482 (PROPOSED RULE) | Myers *et al*.1998; Healey 1991 |
| Lower Columbia River Chinook Salmon | March 24, 1999; 64 FR 14308 | March 9, 1998; 63 FR 11482 (PROPOSED RULE) | Myers *et al*.1998; Healey 1991 |
| Snake River Basin Steelhead | August 18, 1997; 62 FR 43937 | February 5, 1999; 64 FR 5740 (PROPOSED RULE) | Busby *et al*. 1995; Busby *et al*. 1996 |

Table 2 (cont). References for additional background on listing status, biological information, and critical habitat elements for the Listed and Proposed Species addressed in this biological and conference opinion.

| Species | LISTING STATUS FINAL RULE | Critical Habitat | Biological Information, Historical Population Trends |
|---|---|---|---|
| Upper Columbia River Steelhead | August 18, 1997; 62 FR 43937 | February 5, 1999; 64 FR 5740 (PROPOSED RULE) | Busby *et al.* 1995; Busby *et al.* 1996 |
| Middle Columbia River Steelhead | March 25, 1999; 64 FR 14517 | February 5, 1999; 64 FR 5740 (PROPOSED RULE) | Busby *et al.* 1995; Busby *et al.* 1996 |
| Upper Willamette River Steelhead | March 25, 1999; 64 FR 14517 | February 5, 1999; 64 FR 5740 (PROPOSED RULE) | Busby *et al.* 1995; Busby *et al.* 1996 |
| Lower Columbia River Steelhead | March 19, 1998; 63 FR 13347 | February 5, 1999; 64 FR 5740 (PROPOSED RULE) | Busby *et al.* 1995; Busby *et al.* 1996 |
| Columbia River Chum Salmon | March 25, 1999; 64 FR 14308 | March 10, 1998; 63 FR 11774 (PROPOSED RULE) | Johnson *et al.*1997; Salo 1991 |
| S.W. Washington/Lower Columbia River Coastal Cutthroat Trout | April 5, 1999; 64 FR 16397 (PROPOSED RULE) | N/A | Johnson *et al.*1999; Trotter 1989 |

Furthermore, NMFS evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' designated critical habitat. The NMFS must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of the listed species. The NMFS identifies those effects of the action that impair the function of any essential element of critical habitat. The NMFS then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NMFS concludes that the action will adversely modify critical habitat it must identify any reasonable and prudent measures available.

For the proposed action, NMFS's jeopardy analysis considers direct or indirect mortality of fish attributable to the action. NMFS's critical habitat analysis considers the extent to which the proposed action impairs the properly functioning condition of essential elements necessary for adult and juvenile migration of the listed salmon under the existing environmental baseline.

## A. Biological Requirements

The first step in the method NMFS uses for applying the ESA standards of § 7 (a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. NMFS also considers the current status of the listed species taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NMFS starts with the determinations made in its consideration of whether to list the particular species for ESA protection and also considers new data available that is relevant to those determinations (see Table 2 for references).

The relevant biological requirements are those necessary for the listed species to survive and recover to naturally reproducing population levels at which protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stocks, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For this consultation, the biological requirements are adequate water quality, increased migration and spawning (chum salmon below Bonneville Dam) survival and improved habitat characteristics that function to support successful migration and rearing. The current status of the affected listed species, based upon their risk of extinction, has not significantly improved since these species were listed and, in some cases, their status may have worsened due to continuing downward trends toward extinction (see Table 2 for references).

## B. Environmental Baseline

The biological requirements of the listed species are currently not being met under the environmental baseline. Their status is such that there must be a significant improvement in the environmental conditions they experience including the condition of any designated critical habitat (over those currently available under the environmental baseline). The Columbia River below Bonneville Dam has been substantially altered due to diking of lowlands for flood prevention and agriculture; increased inputs of

sewage and storm water run-off from cities; shoreline modification to prevent erosion; installation of docks and marinas; installation of berthing facilities and wharves for shipping. These alterations have modified water quality; altered rearing and spawning habitat; and decreased migration survival. Any continuation, or further, degradation of these conditions would have a significant impact due to the level of risk the listed salmon presently face under the environmental baseline.

## V. ANALYSIS OF EFFECTS

### A. Effects of Proposed Action

Dredging and disposal of the dredged material speed up the natural processes of sediment erosion, transportation and deposition (Morton 1977). The physical effects to the river system from dredging and disposal briefly summarized are: temporary increases in turbidity, changes in bottom topography with resultant changes in water circulation, and changes in the mechanical properties of the sediment at the dredge and disposal sites (Morton 1977). The significance of the effect is a function of the ratio of the size of the dredged area to the size of the bottom area and water volume (Morton 1977).

Potential impacts to listed salmonids from the proposed action include both direct and indirect effects. Potential direct effects include entrainment of juvenile fish (Dutta and Sookachoff 1975, Boyd 1975, Armstrong et al. 1982, Tutty 1976) and mortality from exposure to suspended sediments (turbidity). Potential indirect effects include behavioral (Sigler et al. 1984, Berg and Northcote 1985, Whitman et al. 1982, Gregory 1988) and sub-lethal impacts from exposure to increased turbidity (Sigler, 1988, Sigler et al. 1984, Kirn et al. 1986, Emmett et al. 1988, Servizi 1988); mortality from predatory species that benefit from activities associated with dredged material disposal; mortality resulting from stranding as a result of vessel wakes; modifications to nearshore habitat resulting from erosion as a result of vessel wakes; loss of benthic food sources resulting from dredging and disposal of dredged material (Morton 1977); and cumulative effects of increased industrialization at port facilities located along the river.

Entrainment

Hydraulic suction dredging may entrain juvenile salmonids. When juvenile salmonids come within the "zone of influence" of the cutter head, they may be drawn into the suction pipe (Dutta 1976, Dutta and Sookachoff 1975a). Dutta (1976) reported that salmon fry were entrained by suction dredging in the Fraser River and that suction dredging during juvenile migration should be controlled. Braun (1974), in testing mortality of entrained salmonids, found that 98.8% of entrained juveniles were killed. Dutta and Sookachoff (1975b) indicate that suction dredging operations "cause a partial destruction of the anadromous salmon fishery resource of the Fraser River." Boyd (1975) indicated that suction pipeline dredges operating in the Fraser River during fry migration took substantial numbers of juveniles. As a result of these studies, the Canadian government issued dredging guidelines for the Fraser River to minimize the potential for entrainment (Boyd 1975). Further testing in 1980 by Arseneault (1981) resulted in entrainment of chum and pink salmon but in low numbers relative to the total of salmonids outmigrating (.0001 to .0099%).

However, the Portland District Corps of Engineers conducted extensive sampling within the Columbia River in 1985-88 (Larson and Moehl 1990) and again in 1997 and 1998. In the 1985-88 study no juvenile salmon were entrained and the 1997-98 study resulted in entrainment of only two juvenile salmon. McGraw and Armstrong's (1990) examination of fish entrainment rates in Grays Harbor from 1978 to 1989 resulted in only one juvenile salmon being entrained. However, dredging was conducted outside peak migration times. Stickney (1973) also found no evidence of fish mortality while monitoring dredging activities along the Atlantic Intracoastal Waterway. These studies were on deep water areas associated with main channels. There is little information on the extent of entrainment in shallow water areas, such as those associated with the side channels proposed as part of maintenance dredging. Further information is needed to determine if dredging in these shallow water areas may entrain juvenile salmonids.

Turbidity

NMFS expects the turbidity generated from the dredging process to be very small and confined to the area close to the draghead as a result of the coarseness of the sand being dredged. Issues involving turbidity associated with flowlane disposal were addressed in the 1993 Biological Opinion. NMFS did not believe that mortality resulting from turbidity was an issue of concern during that consultation and has no information that would change that belief for this BO.

Predatory Species

Activities associated with maintenance of the navigation channel have led to increased predation by avian predators such as Caspian terns, cormorants and gulls. Creation and continued use of islands as disposal sites for dredge spoils, and maintenance of pile dike fields and range markers for dredging, provide suitable habitats for large numbers of these birds in the estuary.

Caspian terns are a highly migratory bird that are cosmopolitan in their distribution (Harrison 1983). Along the Pacific Coast they winter in Southern California and Baja California and return north to nest (Harrison 1983) . Since the early 1900's, the population has shifted from small colonies nesting in interior California and Southern Oregon to large colonies nesting on human created habitats along the coast (Gill and Mewaldt 1983). Nests are constructed on bare sand. They are piscivorous in nature and require about 165g of fish per day during nesting (one-third body weight). The preferred food at the Rice Island colony site is juvenile salmonids (Roby et al. 1998).

Roby et al. (1998) estimated that in 1997, 6.6 to 24.7 million salmonid smolts were consumed in the estuary by the Caspian tern colony nesting on Rice Island. Similar factors were applied to nesting cormorants to produce estimates ranging from 2.6 to 5.4 million smolts taken. NMFS biologists estimate that 100,000,000 anadromous salmonid smolts arrived in the Columbia River Estuary in 1997 on their migration to the Pacific Ocean. Totaling the numbers consumed by terns and cormorants produces estimates of total impacts from 9.2 to 30.1 million, or roughly 10 to 30 percent of all smolts in the estuary.

Although the extent of tern predation is substantial, it is a relatively recent phenomenon, occurring primarily since the late 1980's on islands created in the Columbia River estuary by the COE from

dredged material. There were no nesting terns in the estuary prior to 1984 when about 1000 pairs apparently moved from Willapa Bay to nest on East Sand Island. These birds moved to Rice Island in 1986 and have since expanded to over 10,000 pairs (the largest colony in North America). Since 1984, the total number of large piscivorous birds in the estuary has increased from a few hundred cormorants to somewhere in the range of 20,000 terns and 10,000 cormorants. Most of the increase has been since 1990.

Based on the data collected by Roby et al. in 1997, roughly 7-25% of all smolts entering the estuary are consumed by terns. Of these, an estimated 244,000 were listed or proposed for listing under the ESA. Preliminary mortality estimates for 1998 indicate that the Caspian tern colony consumed between 10 and 23 million juvenile salmonids (D. Roby pers. comm. May 11,1999). In 1999, the juvenile out-migration is estimated to be between 6 and 10 million listed fish. Assuming the same consumption ratio as that of 1997, 420 thousand (7% of 6 million fish) to 2.5 million (25% of 10 million fish) listed fish would be consumed by the tern colony in 1999.

Cormorants utilize the 236 pile dikes that have been installed within the action area to direct channel flow and help minimize dredging. The birds perch on the tops of the dikes and use them as launching platforms for feeding forays in the slack water created by the dike or as sunning platforms. In addition, cormorants use the dredging range markers in the estuary for nesting platforms. The preliminary estimate for the number of juvenile salmonids consumed by the double-crested cormorants nesting on East Sand Island, Rice Island, and associated channel markers and structures in the Columbia River estuary in 1998 is 5 to 14 million (D. Roby pers. comm. May 11, 1999).

Preliminary estimates of total juvenile salmonid mortality from cormorants and terns in 1998 is 15 to 37 million, which is 15 to 37% of the total number of juvenile salmon that entered the estuary and roughly 8 to 19% of the total production of juveniles in the Columbia River Basin[1].
Some mortality of salmonids resulting from avian predation in the estuary is normal and part of the balance within any ecosystem. Reducing avian predation within the estuary to zero is not feasible. However, as stated in the NMFS Biological Opinion on the Caspian Tern Relocation Pilot Project (February 25,1999), "Continued avian predation on juveniles at 1997-1998 levels will, at a minimum, hinder recovery of listed species."

The use of dredge disposal islands and pile dike fields by avian predators is not a new occurrence. The creation of disposal islands and pile dikes as a result of operation and maintenance of the navigation channel provided significant habitat for avian predators and has resulted in significant populations becoming established in the basin, resulting in impacts to salmonids. The continued operation and maintenance of the navigation channel allows for these predatory birds to maintain, and potentially increase, their populations, with subsequent increased impacts to salmonids. Cessation of dredge spoil disposal on islands would allow for the eventual establishment of vegetation that would preclude tern nesting. This would require a significant length of time at sites such as Rice Island. Discontinuing

[1] In 1998 total production of smolts in the Columbia River Basin was estimated at 200 million, of which only 100 million were estimated to have reached the estuary.

maintenance of pile dikes would eventually result in their decay and removal. This also would require a substantial period of time.

The proposed action calls for the continued placement of spoils on twelve islands below Bonneville Dam, seven with disposal annually and five at various times ranging from every two out of three years to every seventh year. Rice Island is the largest of the islands being utilized and, as mentioned above, supports a significant population of predatory birds. Continued placement of dredge spoils on this island will preclude the establishment of vegetation and allow for continued use by avian predators. The other islands are located further upriver. The majority of these upriver islands are also vegetated outside of the disposal areas and may support a more diverse population of birds and mammals. It is possible that avian predators such as Caspian terns could utilize some of these upriver sites as nesting areas. However, most of these sites have been utilized extensively in the past for disposal and birds have not established breeding colonies on them. The COE's proposed preclusion of avian predators from Rice Island and nearby islands will alleviate the impact to salmonids associated with avian colonies utilizing dredge spoil islands for nesting.

As part of the 1999 Caspian Tern Pilot Relocation Project, the COE created 16 acres of Caspian tern nesting habitat on East Sand Island to allow for relocation of the tern colony from Rice Island[2]. The research team hypothesized that relocating the colony to East Sand Island, near the river mouth, will shift the tern diet toward alternate species and reduce predation on smolts. There is some evidence that both terns and cormorants feeding near the river's mouth take a higher proportion of alternate species including herring, smelt and surf perch. Early indications from observations in 1999 are that roughly 44% of the fish delivered to East Sand Island were salmonids, compared to 75% at Rice Island (Ken Collis, personal communication). The Caspian Tern Working Group has not finalized plans for what activities will occur on East Sand Island in 2000. However, the 16 acres that the COE created in 1999 were intended to accommodate 90% of the colony nesting at Rice Island and impacts to listed species were addressed in the Biological Opinion on the relocation project. Any activities that the COE would undertake in 2000 would not create any new habitat on East Sand Island, therefore any impacts that may be associated would not be beyond that already addressed.

The continued maintenance of pile dikes and range markers will allow for their continued use by predators such as cormorants. This would result in mortality rates comparable to those currently being experienced, and potentially increased, as these populations continue to increase. The COE's proposed development and implementation of techniques to preclude avian predator usage of these facilities will substantially alleviate avian impacts to juvenile salmonids in the vicinity of these structures.

Stranding

[2]East Sand Island is currently being utilized as a nesting colony by terns as part of the Caspian Tern Relocation Pilot Project being conducted by the COE and other resource agencies in an attempt to reduce avian predation in the Columbia River estuary in the short term, while the Caspian Tern Working Group develops a long-term management plan. Depending on the results of current studies underway, there may be the potential to leave a small colony of terns in the estuary that would pose minimal risk to salmonids. If the results show this is not feasible, the COE will have to consider East Sand Island as a risk to fish and tern usage of the site will need to be prevented.

Stranding of juveniles by ship wakes was identified as a significant cause of juvenile mortality by the Washington Department of Fish and Wildlife (Hinton and Emmett 1994). Hinton and Emmett (1994), citing research conducted in 1974 and 1975 by K. Bauersfeld of the Washington Department of Fisheries, state that stranding rates were as high as 117 fish per vessel passage. They also cite observations of high numbers of strandings at Jones Beach after vessel passage by NMFS personnel in 1977 and 1984. However, observations in 1992 and 1993 by NMFS (Hinton and Emmett, 1994) on stranding indicated that there were many parameters such as vessel speed and shape; distance of vessel from beach; tide stage; beach slope, salmon abundance and condition; and river flow conditions that lead to stranding by juveniles. They indicated that stranding was not presently a significant cause of juvenile salmonid mortality. Hinton and Emmett (1994) reiterated the recommendation put forth by the Washington Department of Fisheries that measures such as disposal berms be sloped to a 9% gradient and vessel speed limits of 26 km/h along certain river stretches be implemented to reduce the potential for stranding. They also recommended that there be periodic surveys conducted to see if the measures are being followed and stranding is not occurring.

Erosion

Ship wake erosion is becoming a major problem in the Columbia River downstream of the cities of Portland and Vancouver. Housing next to the river has increased and the requests for modifications to shorelines through beach nourishment or riprap placement to protect property from erosion caused by ship wakes has also subsequently increased. These modifications increase potential predation and decrease benthic invertebrate populations. Facilitation of vessel transit through channel maintenance continues to exacerbate this problem.

Benthic Resources

Benthic invertebrates in subtidal and intertidal habitats are key food sources for juvenile salmonids during the outmigration (McCabe and Hinton 1998). Beach nourishment adversely impacts benthic populations and is the reason why the COE has reduced the use of beach nourishment sites for dredge spoil disposal. The sites that are currently proposed are of low density and of little value currently to juveniles. The benthic invertebrate populations within the navigation channel have been shown to be of low density and of low value to juvenile salmonids.

The side channel at Westport Slough was studied in 1993 for impacts to benthic invertebrates resulting from dredging operations and no significant effect on densities or significant changes in community structure were detected (McCabe et al. 1996). The study found that recolonization by invertebrates was rapid (McCabe et al. 1996). The Jetty A disposal site was evaluated by prior to its use and determined to have a low biological standing crop of invertebrates (Durkin et al. 1981). Hinton et al. (1995), while studying potential estuarine restoration areas, found that erosive areas of the estuary had significantly less invertebrate densities than shallow, subtidal habitats upstream of Miller Sands Island. Densities of invertebrates were also found to fluctuate seasonally within the estuary (Hinton et al. 1995). There will be some short-term impact to invertebrate colonies as a result of dredging. However, the low densities of invertebrates in the main channel and rapid recolonization rates indicate that this would be of minimal impact to salmonids.

Increased Industrialization

While beyond the scope of the COE's current maintenance project, increased industrialization is an indirect effect of the channel maintenance. Facilitation of vessel transit has led, and continues to lead, to expansion of port facilities all along the Columbia River. This results in increases in dredging around dock facilities, alteration of riparian areas, loss of riparian areas, increased pollution, alteration and loss of shallow water habitat and requests for deeper channels to enable ports to compete with other port facilities along the west coast.

## B. Critical Habitat

There are five critical habitat elements that may be affected by this action: riparian vegetation, water quality, substrate, food and safe passage. The COE has avoided placement of dredge spoils in upland areas that are currently providing riparian vegetation. As mentioned above, water quality will not be adversely affected by the slight increase in turbidity. The lack of fine grained material in the channel decreases the potential for any toxics to be resuspended as part of the dredging process. The substrate in disposal areas and the channel are generally uniform in size and will not be significantly altered as a result of dredging or disposal. Benthic invertebrate populations are of low densities within the navigation channel and of limited value to salmonid species. Dredging will temporarily decrease densities of invertebrates, but recolonization of newly deposited substrates to pre-dredging levels has been shown to occur relatively quickly. As mentioned above, entrainment is not an issue regarding safe passage. However, the COE has been conducting an analysis of the behavior of juvenile salmonids around pile dikes (Carlson 1999 in preparation). Results indicate that juvenile salmonids migratory behavior is modified by the pile dikes through changing the way they move downriver (move along the face of the dike and out around the tip) where they may be more susceptible to predation by birds and other fish. In addition, juvenile fish tend to hold in the slack water behind the dikes during nighttime. This may also make them more vulnerable to predation by fish and avian predators. Further study of these impacts is necessary to determine the extent of any potential impacts.

## C. Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." For the purposes of this analysis, the action area encompasses the Columbia River from the mouth to McNary Dam at river mile 292. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. The NMFS knows of no non-Federal actions that are reasonably certain to occur that may take listed salmonids within the action area.

## VI. CONCLUSION

NMFS has determined that, based on the best available scientific information, the continued maintenance of the Columbia River Navigation Channel is not likely to jeopardize the continued existence of Snake River sockeye salmon, Snake River spring/summer chinook salmon, Snake River fall chinook salmon, Snake River steelhead, Upper Columbia River steelhead, Lower Columbia River steelhead, Upper Willamette River steelhead, Middle Columbia River steelhead, Columbia River chum salmon, Lower Columbia River chinook salmon, Upper Willamette River chinook salmon, Upper Columbia River spring run chinook salmon and Southwestern WA/Columbia River coastal cutthroat trout or result in the destruction or adverse modification of critical habitat. The NMFS believes that the net effect of the proposed action is to improve the survival of the listed salmon when compared to the level of survival under the current environmental baseline.

The NMFS reached this conclusion based on the fact that: 1) entrainment of juvenile salmonids and increased turbidity are not expected to occur; 2) the COE will prevent the continued use of dredge spoil islands, range markers and pile dike fields by avian predators; 3) impacts to benthic invertebrates will be minimal; and 4) critical habitat will not be adversely affected. The NMFS believes that erosion and increased industrialization are affecting salmonids in the Columbia River, but currently not at a level that would jeopardize the continued existence of any of the listed species. In addition, NMFS believes that further analysis of juvenile salmonid utilization and potential fish predation associated with pile dikes should be completed.

## VII. CONSERVATION RECOMMENDATIONS

Section 7 (a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information. NMFS believes the following conservation recommendations are consistent with these obligations, and therefore should be implemented by the COE.

1. The COE should work with NMFS to evaluate the use of pile dike fields by other fish species that may prey on juvenile salmonids. Based on the findings of these studies, further measures to reduce predation, if found to be problematic, should be developed.
2. The COE should conduct periodic analyses of vessel wake induced stranding of juvenile salmonids along the Columbia River below Bonneville Dam.
3. The COE should work with NMFS, the U.S. Coast Guard and the river pilots to develop vessel speed limits that would reduce the potential for stranding of juvenile salmon from ship wakes and exacerbated river bank erosion.
4. The COE should, in conjunction with resource agencies, look for opportunities to improve estuarine and ocean habitats.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed species or their habitat, NMFS requests notification of the implementation of any conservation recommendations.

## VIII. REINITIATION OF CONSULTATION

Consultation must be reinitiated at the end of five years from the date of signature on this BO, or if: The amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; new information reveals effects of the action may affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; or, a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

## IX. REFERENCES

Armstrong, D.A., B.G. Stevens, and J.C. Hoeman. 1982. Distribution and abundance of Dungeness crab and *Crangon* shrimp, and dredged-related mortality of invertebrates and fish in Grays Harbor, Washington. Tech. Rpt. School

of Fisheries. Univ. of Washington, Washington Department of Fisheries, and Seattle District Corps of Engineers. 349 pp.

.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill-flaring and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Can. J. Fish. Aquat. Sci. 42:

1410-1417.

Boyd, F.C. 1975. Fraser River dredging guide. Tech. Rpt. Series No. PAC/T-75-2. Fisheries and Marine Service, Environment Canada.

Braun, F. 1974. Monitoring the effects of hydraulic suction dredging on migrating fish in the Fraser River Phase II. Department of Public Works, Pacific Region, Canada.

Braun, F. 1974b. Monitoring the effects of hydraulic suction dredging on migrating fish in the Fraser River Phase I. Department of Public Works, Pacific Region, Canada.

Burgner, R.L. 1991. Life history of sockeye salmon (*Oncorhynchus nerka*). Pages 1-117 *In:* Groot, C. and L. Margolis (eds.). 1991. Pacific salmon life histories. Vancouver, British Columbia: University of British Columbia Press.

Busby, P., S. Grabowski, R. Iwamoto, C. Mahnken, G. Matthews, M. Schiewe, T. Wainwright, R. Waples, J. Williams, C. Wingert, and R. Reisenbichler. 1995. Review of the status of steelhead (*Oncorhynchus mykiss*) from Washington, Idaho, Oregon, and California under the U.S. Endangered Species Act. 102 pp. plus 3 appendices.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-27, 261 pp.

Durkin, J.T., T.C. Coley, K. Verner, and R.L. Emmett. 1981. An aquatic species evaluation at four self scouring sites in the Columbia River estuary. National Marine Fisheries Service Coastal Zone and Estuarine Studies. Seattle, Washington. 46 pp.

Dutta, L.K., 1976. Dredging:Environmental effects and technology. Pages 301-319 *In:* Proceedings of WODCON VII. World Dredging Conference, San Pedro, California.

Dutta, L.K. and P. Sookachoff. 1975a. Assessing the impact of a 24" suction pipeline dredge on chum salmon fry in the Fraser River. Fish. And Marine Serv., Environment Canada, Tech. Rep. Ser. No. PAC/T-75-26. 24 pp.

Dutta, L.K. and P. Sookachoff. 1975b. A review of suction dredge monitoring in the lower Fraser River, 1971-1975. Fish. And Marine Serv., Environment Canada, Tech. Rep. Ser. No. PAC/T-75-27. 100 pp.

Emmet, R.L., G.T. McCabe, Jr. and W.D. Muir. 1988. Effects of the 1980 Mount St. Helens eruption on Columbia River estuarine fishes: implications for dredging on Northwest estuaries. Pages 74-91 *In:* C. A. Simenstad (ed.) Effects of dredging on anadromous Pacific coast fishes. Washington Sea Grant Program. Washington State University. Seattle, Washington.

Gill, R.E. Jr., and L.R. Mewaldt. 1983. Pacific Coast Caspian Terns: Dynamics of an Expanding Population. The Auk 100:369-381.

Gregory, R. S. 1988. Effects of Turbidity on benthic foraging and predation risk in juvenile chinook salmon. Pages 64-73 *In:* C. A. Simenstad (ed.) Effects of dredging on

anadromous Pacific coast fishes. Washington Sea Grant Program. Washington State University. Seattle, Washington.

Haley, D. ed. 1984. Seabirds of Eastern North Pacific and Arctic Waters. Pacific Search Press. Seattle. 214 pp.

Harrison, P. 1983. Seabirds: an Identification Guide. Houghton Mifflin Company. Boston. 448 pp.

Healey, M.C. 1991. Life history of chinook salmon (*Oncorhynchus tshawytscha*). Pages 311-393 *In:* Groot, C. and L. Margolis (eds.). 1991. Pacific salmon life histories. Vancouver, British Columbia: University of British Columbia Press.

Hinton, S.A. and R.L. Emmett. 1994. Juvenile salmonid stranding in the Lower Columbia River, 1992 and 1993. NOAA Technical Memorandum NMFS-NWFSC-20.

Hinton, S.A., G.T. McCabe, Jr., and R.L. Emmett. 1995. In-water restoration between Miller Sands and Pillar Rock Island, Columbia River: environmental surveys, 1992-93. NOAA Technical Memorandum NMFS-NWFSC-23. Seattle, Washington. 27 pp.

Johnson, O.W., W.S. Grant, R.G. Cope, K. Neely, F.W. Waknitz, and R.S. Waples. 1997. Status review of chum salmon from Washin

gton, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-32, 280 pp.

Johnson. O.W., M.H. Ruckelshaus, W.S. Grant, F.W. Waknitz, A.M. Garrett, G.J. Bryant, K. Neely, and J.J. Hard. 1999. Status review of coastal cutthroat trout from Washington, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-37, 292 pp.

Kirn, R.A., R.D. Ledgerwood and A.L. Jensen. 1986. Diet of subyearling chinook salmon (*Oncorhynchus tshawytscha*) in the Columbia River estuary and changes effected by the 1980 eruption of Mount

St. Helens. Northwest Science 60:191-195.

Matthews, G.M. and R.S. Waples. 1991. Status review for Snake River spring and summer chinook salmon. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-F/NWC-200, 75 pp.

McCabe, G.T., Jr., S.A. Hinton, and R.L. Emmett. 1996. Benthic invertebrates and sediment characteristics in Wahkiakum County Ferry Channel, Washington, before and after dredging. National Marine Fisheries Service Coastal Zone and Estuarine Studies Division. Seattle, Washington. 32 pp.

McCabe, G.T., Jr. and S.A. Hinton. 1998. Benthic invertebrate and sediment characteristics in and adjacent to a proposed channel widening area (river mile 31-34), Columbia River estuary. National Marine Fisheries Service Fish Ecology Division. Seattle, Washington. 21 pp.

Morton, J.W. 1977. Ecological effects of dredging and dredge spoil disposal: a literature review. U.S. Fish and Wildlife Service Technical Paper

No. 94. 33 pp.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-35, 443 p.

National Marine Fisheries Service (NMFS) . 1995. Biological Opinion for Reinitiation of Consultation on 1994-1998 Operation of the Federal Columbia River Power System and Juvenile Transportation Program in 1995 and Future Years. Northwest Region National Marine Fisheries Service. Portlan

d, Oregon. 166 pp.

ODFW and WDFW. 1998. Status Report Columbia River Fish Runs and Fisheries, 1938-1997. 299 pp.

Roby, D.D., D.P. Craig, K. Collis, and S.L. Adamany. 1998. Avian Predation on Juvenile Salmonids in the Lower Columbia River 1997 Annual Report. Bonneville Power Administration Contract 97BI33475 and U.S. Army Corps of Engineers Contract E96970049. 70 pp.

Salo, E.O. 1991. Life history of chum salmon (*Oncorhynchus keta*). Pages 231-309 *In:* Groot, C. and L. Margolis (eds.). 1991. Pacific salmon life histories. Vancouver, British Columbia: University of British Columbia Press.

Servizi, J.A. 1988. Sublethal effects of dredged sediments on juvenile salmon. Pages 57-63 *In:* C. A. Simenstad (ed.) Effects of dredging on anadromous Pacific coast fishes. Washington Sea Grant Program. Washington State University. Seattle, Washington.

Sigler, J.W. 1988. Effects of chronic turbidity on anadromous salmonids: recent studies and assessment techniques perspective. Pages 26-37 *In:* C. A. Simenstad (ed.) Effects of dredging on anadromous Pacific coast fishes. Washington Sea Grant Program. Washington State University. Seattle, Washington.

Sigler , J. W., T.C. Bjorn and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of

steelheads and coho salmon. Trans. Am. Fish. Soc. 111:63-69.

Stickney, R.R. 1973. Effects of hydraulic dredging on estuarine animlas studies. World Dredging Mar. Const.: 34-37.

Trotter, P.C. 1989. Coastal cutthroat trout: A life history compendium. Trans. Am. Fish. Soc. 118:463-473.

Tutty, B. D. 1976. Assessment of techniques used to quantify salmon smolt entrainment by a hydraulic suction hopper dredge in the Fraser River estuary. Fish. And Mar. serv. Environment Canada. Tech. Rept. Ser. No. PAC/T-76-16.

Waples, R.S., O.W. Johnson, and R.P. Jones, Jr. 1991a. Status Review for Snake River Sockeye Salmon. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/NWC195.

Waples, R.S., R.P. Jones, Jr., B.R. Beckman, and G.A. Swan. 1991b. Status Review for Snake River Fall Chinook Salmon. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-201. 73 p.

Whitman, R.P., T.P. Quinn and E.L. Brannon. 1982. Influence of suspended volcanic ash on homing behavior of adult chinook salmon. Trans. Am. Fish. Soc. 113:142-150.

## X. INCIDENTAL TAKE STATEMENT

Sections 4 (d) and 9 of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patters such as breeding, feeding, and sheltering. Harass is defined as actions that create the likelihood of injuring listed species to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary; they must be implemented by the action agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The COE has a continuing duty to regulate the activity covered in this incidental take statement. If the COE (1) fails to adhere to the terms and conditions of the incidental take statement, and/or (2) fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

## A. Amount or Extent of the Take

The NMFS anticipates that the action covered by this BO has more than a negligible likelihood of resulting in incidental take of listed and proposed species because of continued predation by avian predators utilizing pile dikes and range markers associated with navigation channel maintenance until such time as they are modified or removed. The subject action, however, as described in the BO and modified by the terms and conditions, should result in an increase in the survival of juvenile listed and proposed species in the proposed action area over the environmental baseline. Therefore, even though the NMFS expects a short-term level of incidental take to occur as the COE implements the project covered by this BO, the best scientific and commercial data available are not sufficient to enable NMFS to estimate a specific amount of incidental take to the listed and proposed species themselves. In instances such as these, the NMFS designates the expected level of take as "unquantifiable." Based on the information in the BA, the NMFS anticipates that an unquantifiable amount of incidental take could occur as a result of the action covered by this BO.

## B. Reasonable and Prudent Measures

The NMFS believes that the following reasonable and prudent measure(s) are necessary and appropriate to minimize take of listed anadromous salmonids in the Columbia River Basin:

1. The COE shall reduce avian predation associated with dredge disposal islands, pile dikes and range markers.
2. The COE shall utilize best management practices to reduce the potential for entrainment of juvenile salmonids.

## C. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the COE must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1a. The COE shall modify the habitat on Rice Island by April 1, 2000, so that it is no longer suitable as a nesting site for Caspian terns or provide for the hazing of terns off the island in a manner that will preclude their nesting. The COE shall ensure that any terns hazed off the island do not nest on any dredge spoil islands in the action area (other than East Sand Island). The COE shall continue to prevent nesting of Caspian terns on disposal islands within the action area for the life of the project.

1b. The COE shall work with NMFS to identify methods to prevent cormorant usage of COE maintained pile dikes. The COE shall then modify these pile dikes so that they are unable to be utilized by cormorants for resting and loafing or as feeding platforms. The COE shall modify COE maintained pile dikes located in the Columbia River Estuary around Rice Island, Miller Sands and East Sand Island by April 1, 2000. The COE shall monitor the success of the efforts in preventing cormorant usage in that area during the spring and summer of 2000. If the techniques are successful, the COE shall begin modifications on all COE maintained pile dikes throughout the action area in coordination with NMFS. If the techniques are unsuccessful, the COE shall further coordinate with NMFS to develop other methodologies of prevention.

1c. The COE shall work with NMFS to identify methods to dissuade cormorant usage of COE maintained in-water structures (other than pile dikes and range markers). The COE shall modify these structures located in the estuary by April 1, 2000, so that they are unable to be utilized by cormorants for resting, loafing or as feeding platforms. The COE shall monitor the success of the efforts in dissuading cormorant usage during the spring and summer of 2000. If the techniques are successful, the COE shall begin modifications on all COE maintained in-water structures throughout the action area, with completion of the project by 2002. If the techniques are unsuccessful, the COE shall coordinate with NMFS to determine a schedule for removal of these structures within the project area, with removal of all structures occurring prior to the expiration of this consultation in 2005. Installation of the proposed pile dike field at Jones Beach shall be held in abeyance until such time as the COE demonstrates that techniques for dissuading cormorant usage are successful and that the techniques will be implemented on the proposed pile dikes.

1d. The COE shall remove all dredge range markers within the action area by April 1 of 2002.

2a. The COE shall place the discharge pipe deeper than 20 feet below the surface during flowlane disposal.

2b. The COE shall operate hydraulic dredges with the intake at or below the surface of the material being removed. The intake may be raised a maximum of three feet above the bed for brief periods of purging or flushing of the intake system. At no time shall the dredge be operated at a level higher than three feet above the bed. This includes water being taken in to flush the dredge during disposal.

2c. The COE shall dredge side channels below John Day Dam during the November 1 to February 28 work window if a pipeline dredge is to be utilized. The COE should pre-plan to dredge in those areas only during that time frame. Pipeline dredging operations above John Day Dam shall be conducted during the December 15 and March 15 work window.

2d. The COE shall work with NMFS to develop and conduct an analysis of entrainment by juvenile salmonids as part of dredging operations in side channel areas with waters less than 20 feet in depth. The analysis shall be completed and the results provided to NMFS by 2003.